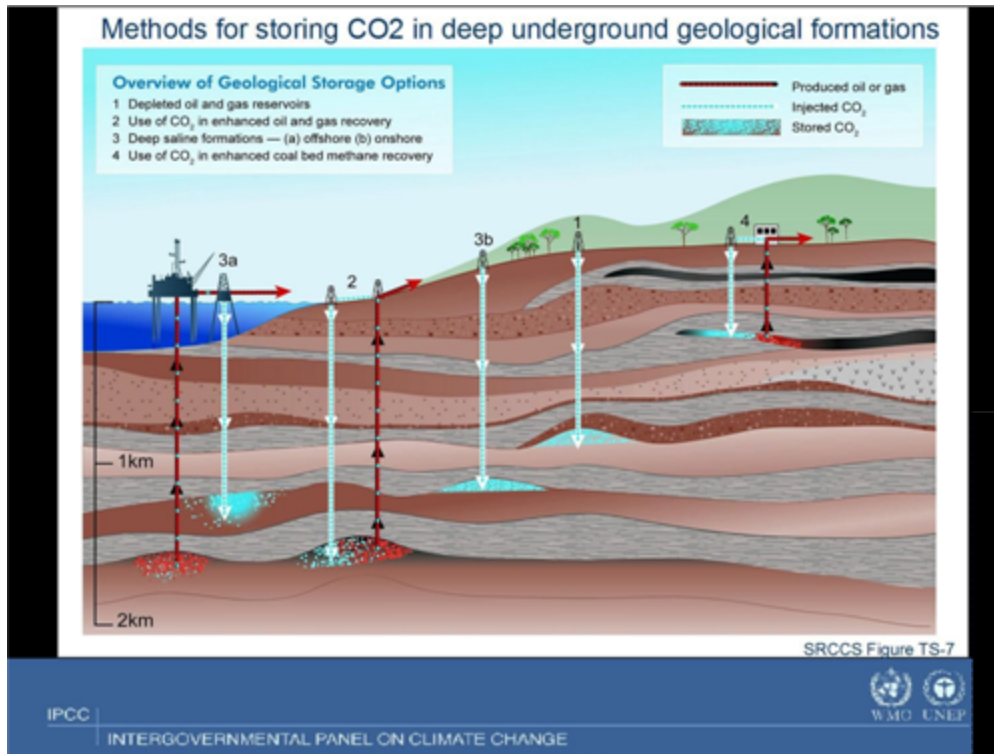
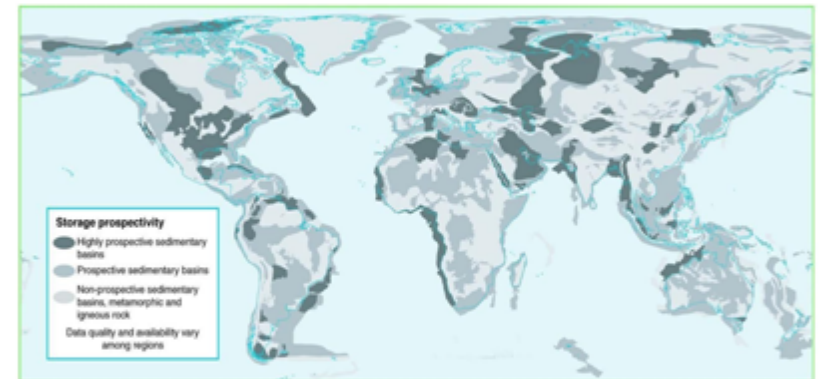


# Carbon Capture and Storage activities in GSI

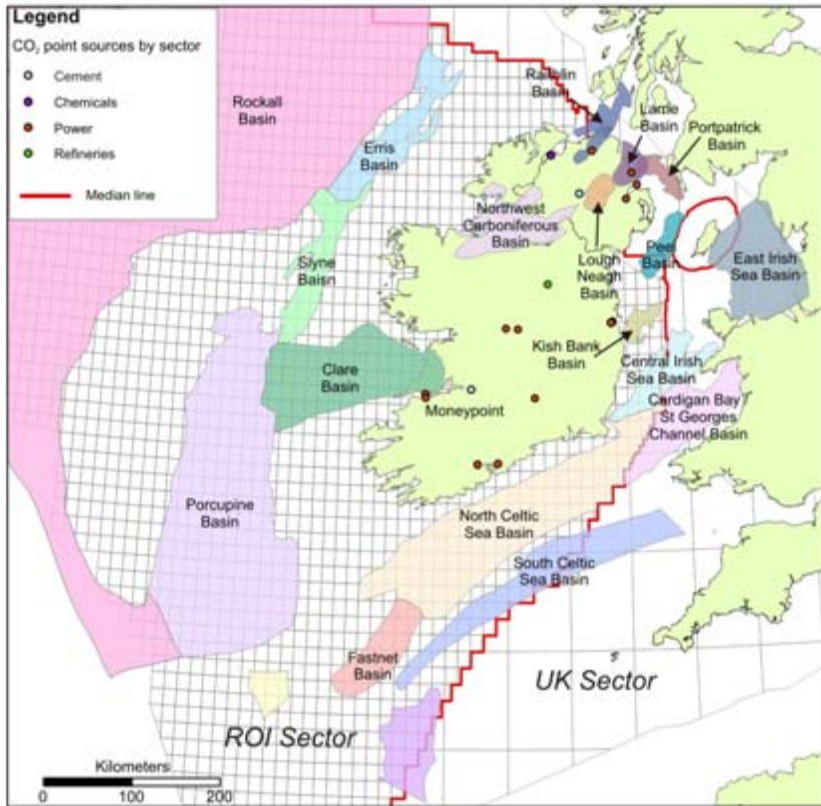
John H. Morris



Prospective areas in sedimentary basins where suitable saline formations, oil or gas fields, or coal beds may be found.



# All-Island study [published by SEI/EPA 2008]



Total quantified but unproven CO2 storage capacity of the Island of Ireland is **93,000 Mt**

Total **practical** storage potential : **1,505 Mt** CO2 hydrocarbon fields incl.

- **Kinsale Head : 330 Mt**
- **East Irish Sea : 1050 Mt**

Total **effective** storage potential : 3,500 Mt

Theoretical storage in Permo-Triassic aquifers, east coast and UK Irish Sea

Unquantified potential in western basins (Spanish Point : 120 Mt)

Ireland total emissions: 28.8Mt/year  
 Moneypoint emissions : 5 Mt/year

The CSA Group

ASSESSMENT OF THE ALL ISLAND POTENTIAL FOR GEOLOGICAL STORAGE OF CARBON DIOXIDE IN IRELAND



JULY 2008

Prepared for Sustainable Energy Ireland, Environmental Protection Agency, Geological Survey of Ireland, Department of Communications, Energy & Natural Resources, and the Department of the Environment, Heritage and Local Government.

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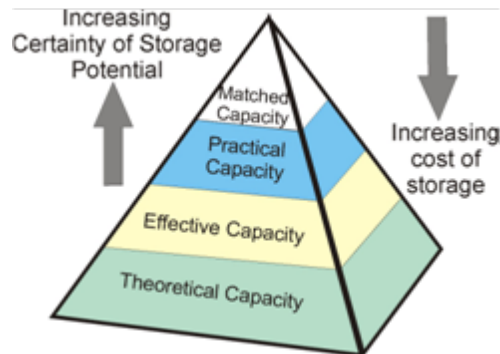
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Basin	Capacity Classification	Quantified Storage capacity Mt
<b>Kinsale Gas Field</b>	<b>Practical</b>	<b>330</b>
South West Kinsale Gas Field	Practical	5
Spanish Point Gas field	Practical	120
<b>East Irish Sea oil and Gas fields</b>	<b>Practical</b>	<b>1050</b>
<b>Total Practical Storage (<i>additional to theoretical &amp; effective</i>) (Mt)</b>		<b>1505</b>
Portpatrick Basin Sherwood Sandstone selected structures	Effective	37
Central Irish Sea Sherwood Sandstone structures	Effective	630
<b>Total Effective Storage (<i>subset of theoretical</i>) (Mt)</b>		<b>667</b>
Lough Neagh Basin Enler Group selected structures	Effective	1940
East Irish Sea Basin Ormskirk structures	Effective	630
<b>Kish Bank Basin Sherwood sandstone structures</b>	<b>Effective</b>	<b>270</b>
<b>Total Effective Storage (<i>additional to theoretical</i>) (Mt)</b>		<b>2840</b>
Celtic Sea - 1 structure in the Cretaceous A sand	Theoretical	40
Portpatrick Basin/ Larne whole basin	Theoretical	2700
<b>Peel Basin Sherwood Sandstone whole basin</b>	<b>Theoretical</b>	<b>68000</b>
Northwest Carboniferous Dowra Basin whole basin	Theoretical	730
<b>Central Irish Sea whole basin</b>	<b>Theoretical</b>	<b>17300</b>
<b>Total Theoretical Storage (Mt)</b>		<b>88,770</b>
<b>TOTAL STORAGE CAPACITY (PRACTICAL/ EFFECTIVE/ THEORETICAL)</b>		<b>93,115 Mt</b>

# All-Island study

## Recommendations for further work

- Further investigation of the gas fields and prospects in the Celtic Sea. Including reservoir simulations of CO<sub>2</sub> injection into the Kinsale Gas field and nearby aquifers. **KINSALE**
- Numerical simulations and site investigation of selected structure and oil and gas fields in the East Irish Sea in order to understand the true storage potential. **IRISH SEA TASK FORCE**
- Practical storage potential of selected Permo - Triassic basins (Kish Bank Basin and Central Irish Sea Basin). To assess the potential using 3D seismic data and further wells drilled, including numerical simulation of CO<sub>2</sub> injection and in order to understand the risk of leakage. **IRISH SEA TASK FORCE**
- Data acquisition and interpretation for the Clare Basin due to its proximity to Moneypoint power station. **CLARE BASIN**

# Recent CCS activities in GSI

## 2008 – ongoing :

**1. Clare Basin** : saline aquifer storage potential in proximity to Moneypoint. Results published by EPA 2010.

**2. Kinsale** : proposed industry-government FP7 project [“CSTORE”] to advance development. Application rejected early 2010.

**3. Irish Sea** : proposed joint UK-Ireland task force to better quantify storage options and potential. GSI-BGS-GSNI research collaboration project, in progress.

**4. CGS** : EU CCS research group expert network. FP7 funded. GSI an active contributor.

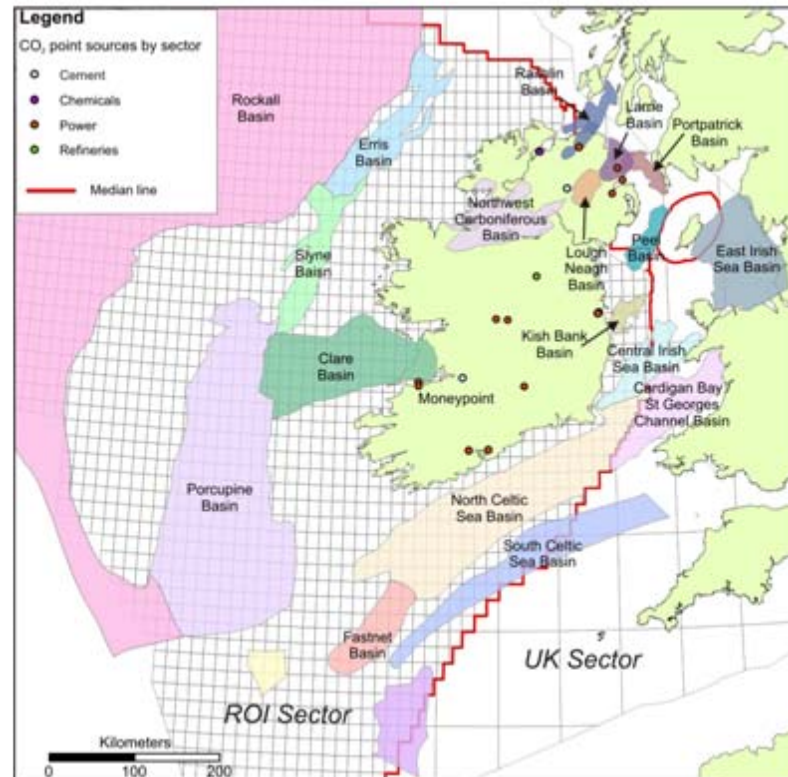
**5. CeltiCarbon** : Match CO<sub>2</sub> “sources” and “sinks” in the southern Irish and Celtic Seas region [INTERREG 4A; FP7]

**Research** : GSI-funded project, UCD, geophysical monitoring [Griffith: Chris Bean]

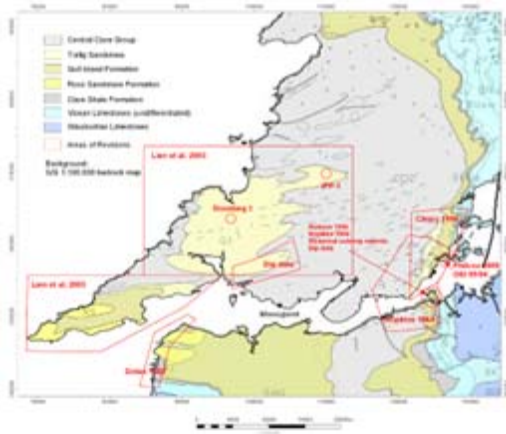
**Regulatory** : Inter-Departmental working group, chaired by DCENR

# 1. CLARE BASIN

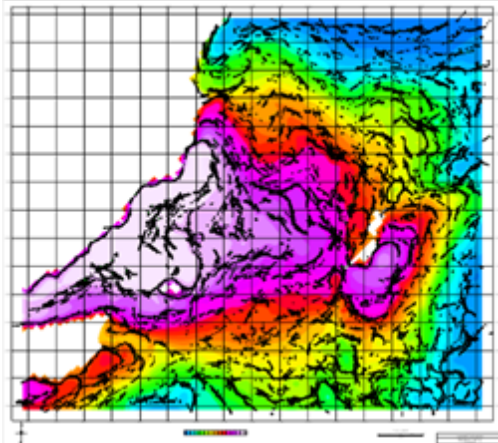
EPA/GSI - Assessment of the Potential for Geological Storage of CO<sub>2</sub> in Hypothetical Deep Saline Aquifers in the vicinity of Moneypoint, Co. Clare.



➤ provision of geological model for final reservoir assessment (TNO)



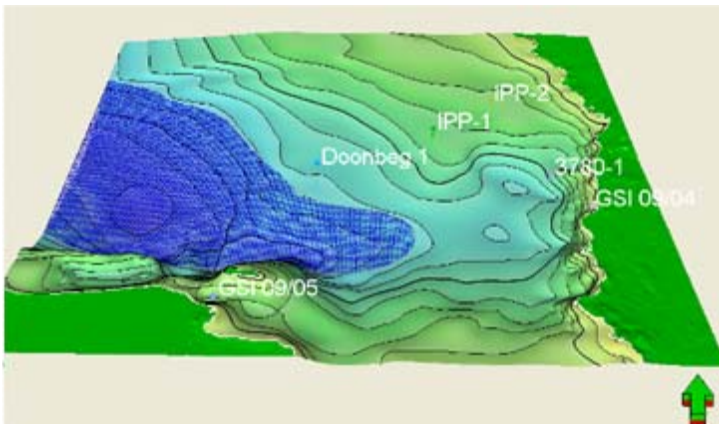
Published bedrock stratigraphy and new field mapping



Historical and new borehole data  
 GSI 09/04 (Killadysert, East Co. Clare)  
 GSI 09/05 (Ballysteer, Ballybunnion, Co. Kerry)

Existing Seismic Data  
 PAD - Shannon Galway Survey of 1962  
 scanned from analogue prints and processed

Existing Regional Geophysical Data  
 DIAS Regional Gravity Data  
 GSI Airborne regional Magnetics Data



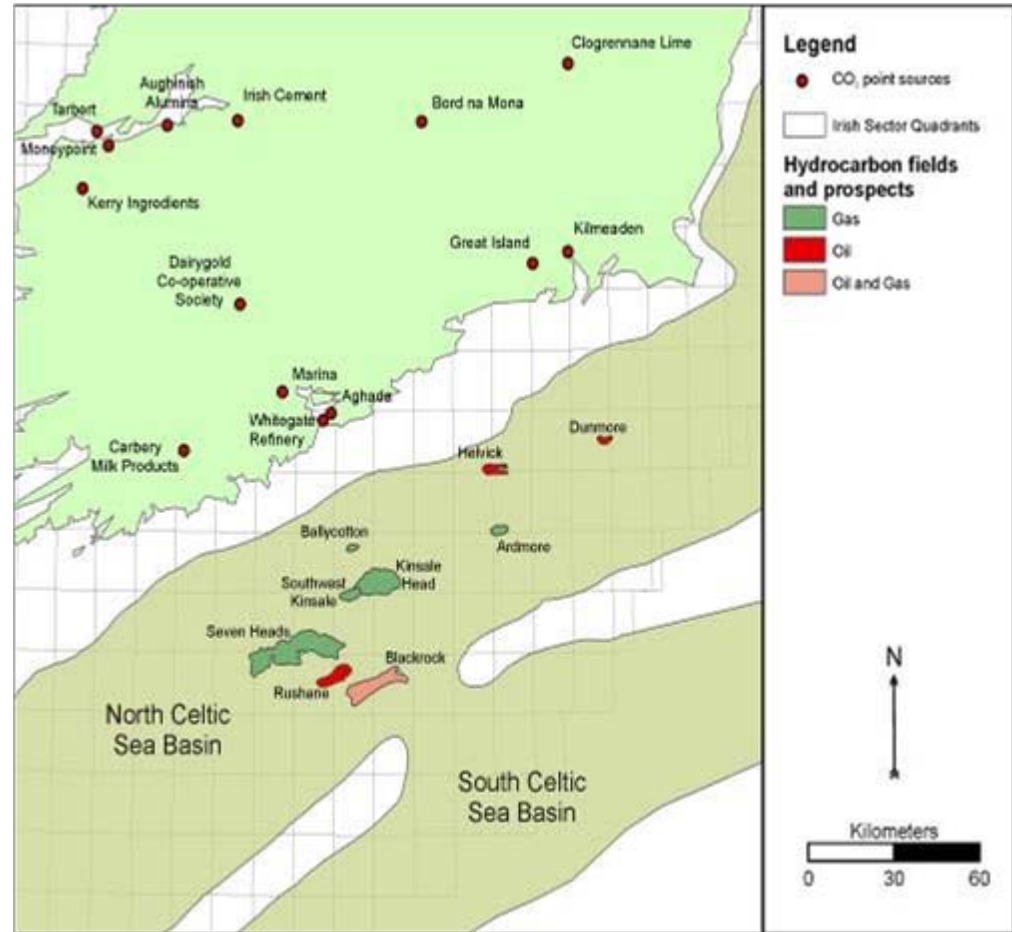
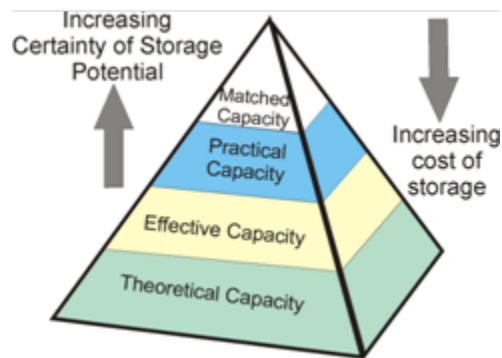


## 2. KINSALE

Reservoir – Lwr Cretaceous Greensands, Gault Clay forming caprock

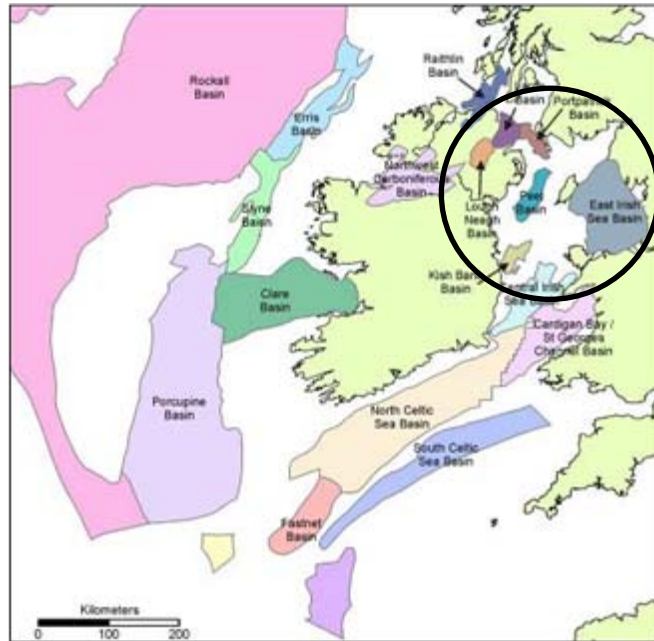
Kinsale Depth of reservoir 838 m and 905 m.

Estimated CO<sub>2</sub> storage capacity-  
**EFFECTIVE/PRACTICAL Kinsale : 330 Mt,**  
SW Kinsale 5.5 Mt



SEI lead FP7 proposal to develop CCS at Kinsale : “**CSTORE**”

### 3. IRISH SEA TASK FORCE – BGS / GSNI / GSI



Permo Triassic Basins

#### IRISH SEA BASINS: indicative storage capacities [ Mt CO<sub>2</sub>]:

##### East Irish Sea [Effective/Practical]

Oil & Gas fields : 1,050 Mt

Ormskirk : 630 Mt

Portpatrick/ Larne : 37 Mt

Kish (Sherwood sdst):  
270 Mt

Central Irish Sea : 630 Mt

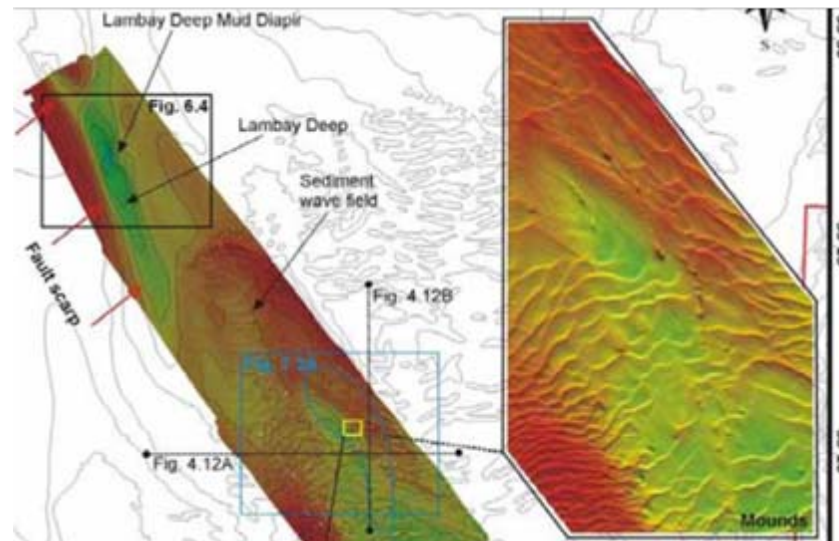
**TOTAL [Effective +] : 2,617 Mt**

## Proposal:

Compile extant data, incl. seeking confidential data, to create an enhanced 3D GIS knowledge resource to : PHASE 1 [2010-2012]

## FUTURE PHASES

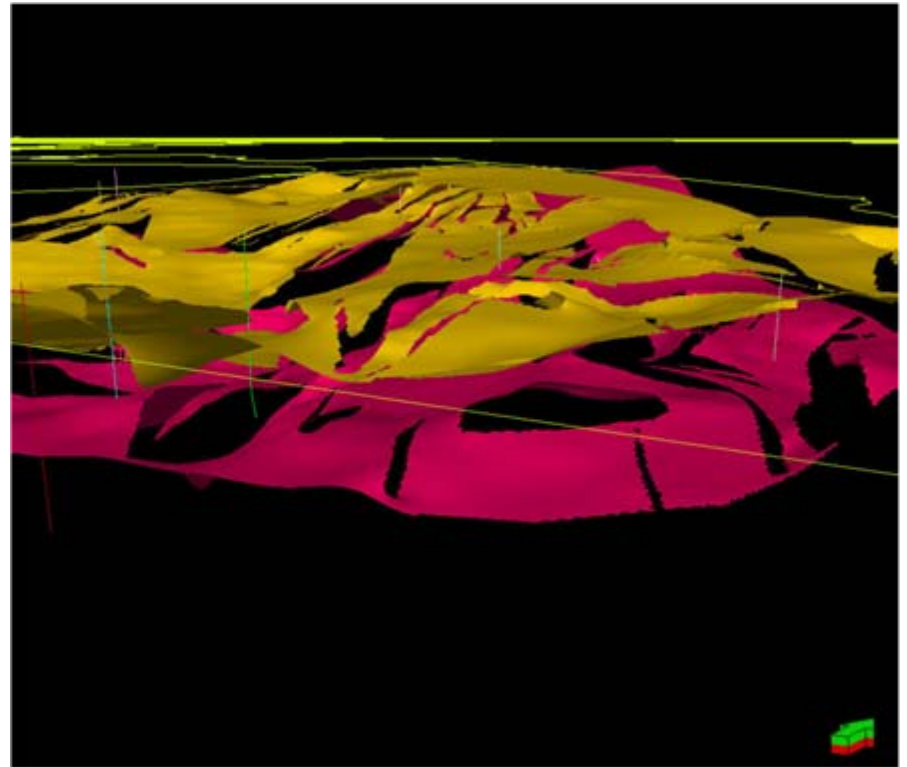
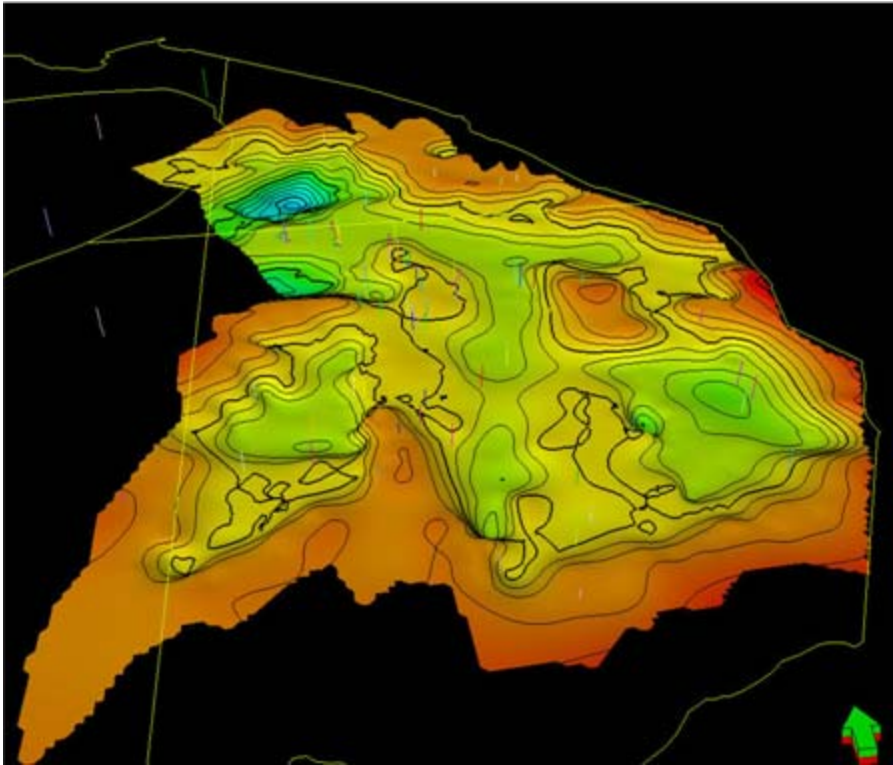
- Seabed mapping, esp. for monitoring potential seepage pathways
- Seismic surveys
- Caprock studies



Risks related to leakage along Codling Fault as shown by MDAC accumulations



# East Irish Sea basin



## 4. CGS



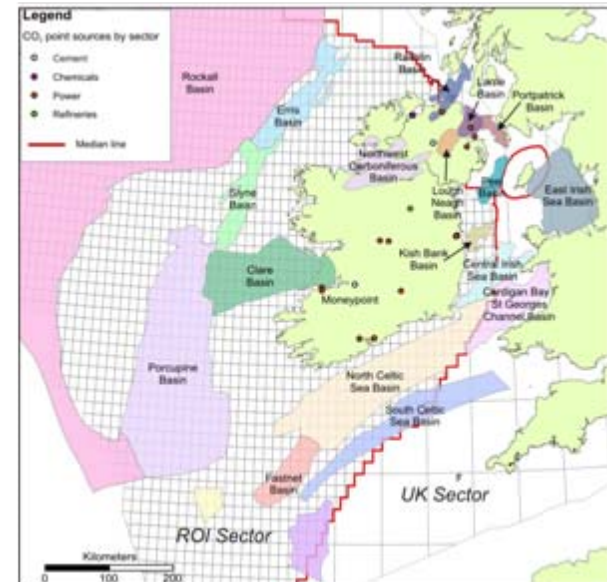
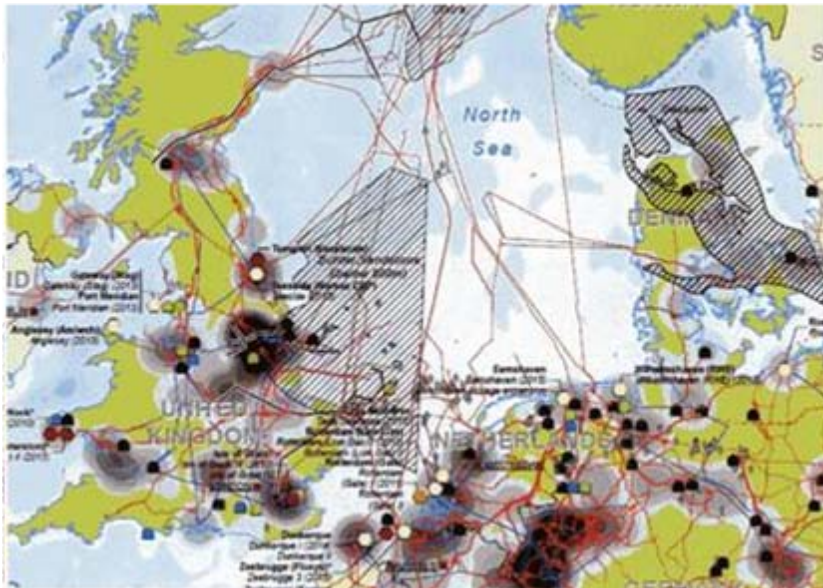
### **FP7 Coordination Action on geological storage of CO<sub>2</sub>**

- **started 1<sup>st</sup> Nov. 2010, runs for 3 years**
- **pools the expertise of existing CO<sub>2</sub>GeoNet, CO<sub>2</sub>NET EAST and ENeRG - 24 EU Member States and 4 Associated Countries**
- **objective - to build a credible, independent and representative pan-European scientific body of expertise on CO<sub>2</sub> geological storage**
- **provides access to a wealth of expertise in partner countries more advanced in CCS development**

# 5. CELTICARBON

## Project concept:

to match CO<sub>2</sub> “sources” in SE Ireland and S. Wales/Bristol Channel “hub” with “sinks” in the Central Irish Sea to Celtic Sea Basins region.



# Envisaged “ Work Packages”:

## 1. CCS Science

- reservoir definition [cf. Irish Sea CCS Phase 1]
- sea bed surveys
- seal/cap rock integrity [targeted 2D and 3D seismic surveys]

## 2. Communicating CCS



**Carbon capture has arrived...**

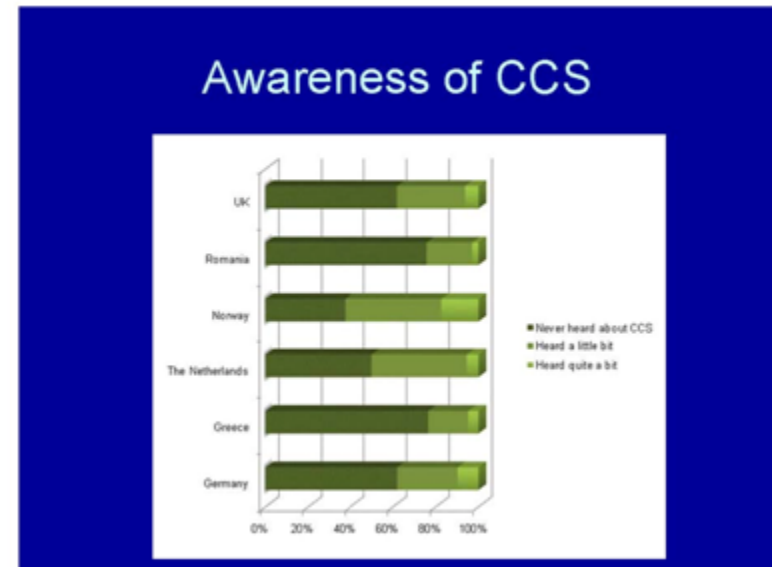
**Sources of Local & National Opposition to CCS**

David M Reiner  
Judge Business School  
University of Cambridge

**nwt** natuur-wetenschap & techniek  
Superklokken Oerastronomen  
Preciezer dan de tijd zelf Sterren kijken in Lantaaar

**BLOW-OUT!**  
HET OORLOG VAN DE WELKE WERD AFBESTEMD

Royal Irish Academy, Dublin  
12 March, 2010

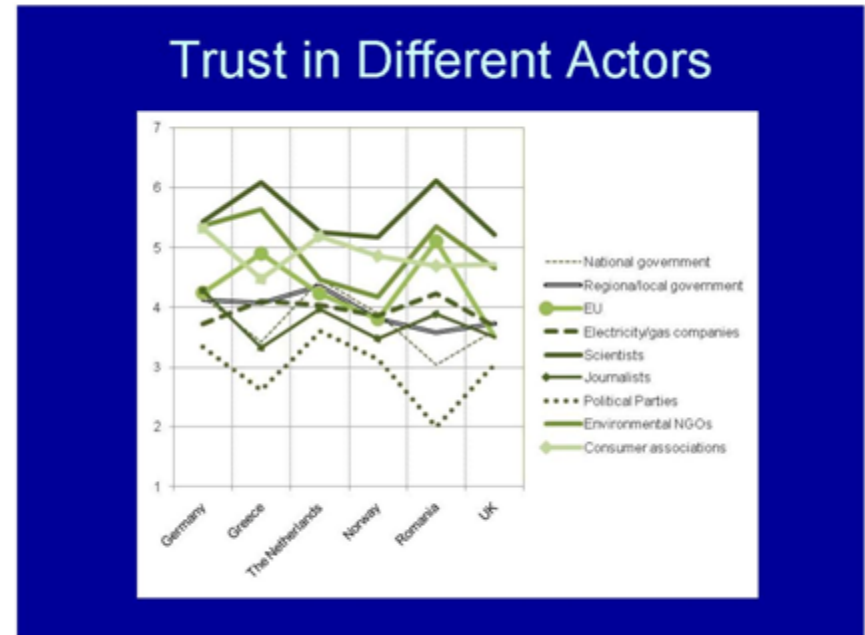


# Envisaged “ Work Packages”:

## 3. CCS acceptability at community level

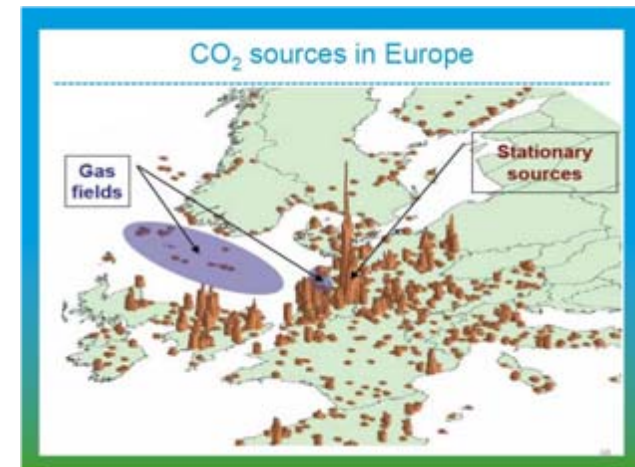
### Results of 3 UK Focus Groups

Main Drawbacks	Main Benefits	Unusual Concerns
Leakage, price, poor regulation and monitoring, short-term, problems for future generations, volatility of gas price, need for research.	Reduce CO <sub>2</sub> emissions to atmosphere, could create jobs.	Terrorism, food supply
Leakage, price, global effort required, safety of coal miners in developing countries, volatility of gas price, need for research.	Reduce CO <sub>2</sub> emissions to atmosphere, allow us to continue current lifestyles, good 'stop-gap'.	Implication of strict population controls to reduce CO <sub>2</sub> usage
Leakage, price, global effort required, safety of coal miners in developing countries, threat to food supply, volatility of gas price, effects on house prices, need for research.	Reduce CO <sub>2</sub> emissions to atmosphere, create jobs, make use of existing storage space	Terrorism, unhappy with the term 'storage' in CCS as it is really disposal of CO <sub>2</sub>

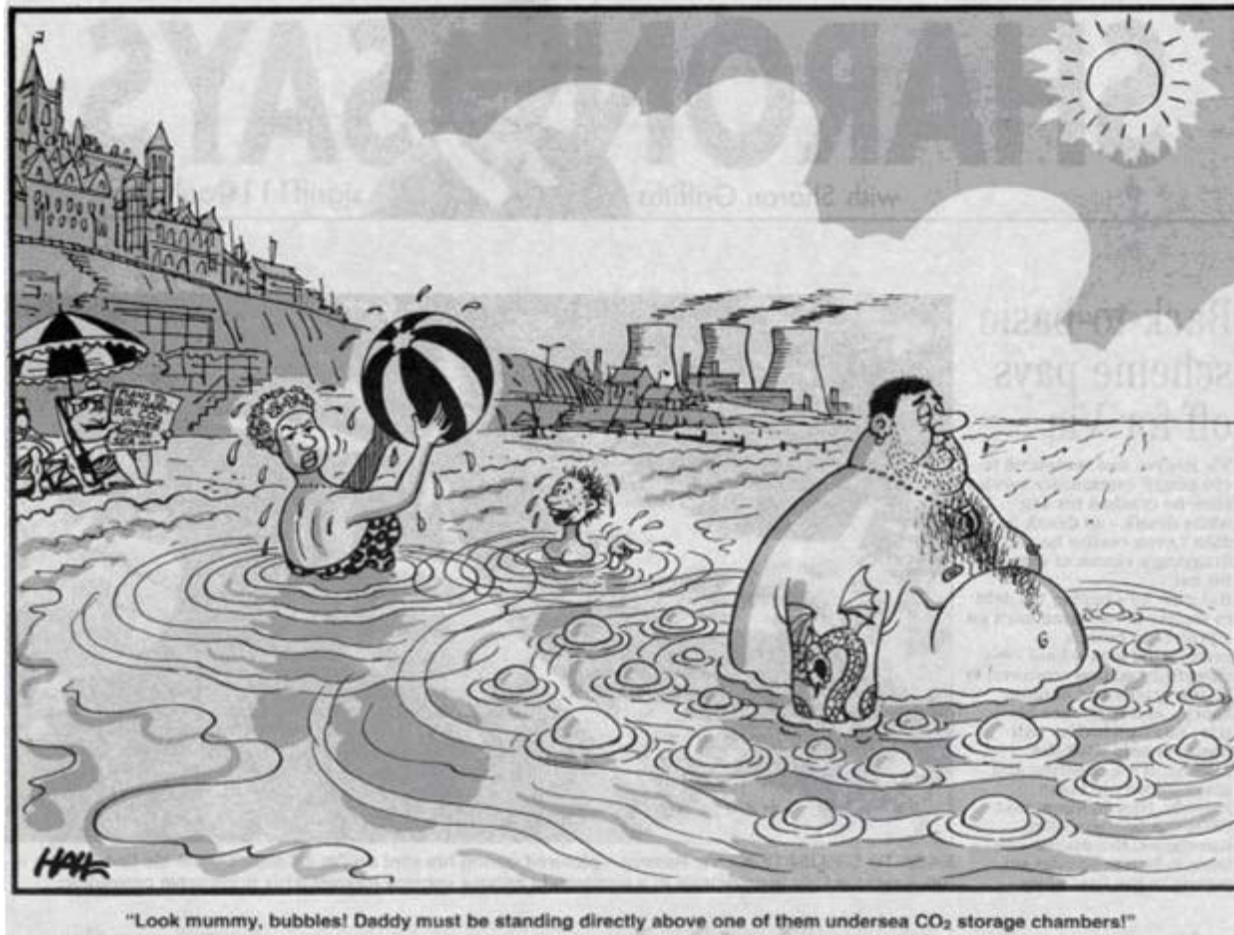


## 4. CCS business case analysis

- “source” to “sink” infrastructure development costs
- reservoir operation costs
- revenue generation [pore space]



# CCS: MORE HOT AIR – OR A SERIOUS, NEW BUSINESS OPPORTUNITY?



Eastern Daily Press [Norfolk, UK] June 2005.